

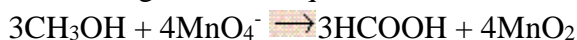
## Chapter 3

### Choose one correct answer:

- Calculate the molar mass of sodium carbonate ( $\text{Na}_2\text{CO}_3$ ).  
a) 106.0 g/mol      b) 82.99 g/mol      c) 89.98 g/mol      d) 122.0 g/mol
- Avogadro's number relates the number of moles of an element to  
a) the mass of the element.  
b) the number of atoms of the element.  
c) the number of protons in the atom of the element.  
d) the number of neutrons in the atom of the element.
- How many atoms are contained in 193.9 g of strontium (Sr)?  
a)  $2.213 \times 10^{24}$  atoms      b)  $1.333 \times 10^{24}$  atoms  
c)  $1.332 \times 10^{-24}$  atoms      d)  $3.675 \times 10^{-24}$  atoms
- What is the mass of 0.229 mol of Mg?  
a) 106 g      b) 5.57      c) 0.180 g      d) 24.5 g
- What mass of  $\text{C}_2\text{H}_6\text{O}$  contains  $3.68 \times 10^{21}$  hydrogen atoms?  
a) 1.68 g      b)  $1.02 \times 10^{-3}$  g      c)  $4.69 \times 10^{-2}$  g      d) 0.281 g
- What is the mass, in grams, of chlorine in 95.8 g of iron (III) chloride ( $\text{FeCl}_3$ )?  
a) 21.0 g      b) 62.9 g      c) 287 g      d) 315 g
- How many atoms of oxygen are in 47.6 g of  $\text{Al}_2(\text{CO}_3)_3$ ? The molar mass of  $\text{Al}_2(\text{CO}_3)_3$  is 233.99 g/mol.  
a)  $1.23 \times 10^{23}$  atoms      b)  $2.96 \times 10^{24}$  atoms  
c)  $2.87 \times 10^{25}$  atoms      d)  $1.10 \times 10^{24}$  atoms
- Balance the following equation with the smallest whole number coefficients. Choose the answer that is the sum of the coefficients in the balanced equation. Do not forget coefficients of "one."  
$$\text{Cr}_2(\text{SO}_4)_3 + \text{RbOH} \rightarrow \text{Cr}(\text{OH})_3 + \text{Rb}_2\text{SO}_4$$
  
a) 10      b) 12      c) 13      d) 14      e) 15
- When the following equation is completed and balanced, what is the coefficient for " $\text{O}_2$ "?  
$$\text{FeS}_2 + \text{O}_2 \rightarrow \text{SO}_2 + \text{Fe}_2\text{O}_3$$
  
a) 2      b) 4      c) 7      d) 8      e) 11
- What is the empirical formula of glucose? The molecular formula of glucose is  $\text{C}_6\text{H}_{12}\text{O}_6$ .  
a)  $\text{C}_6\text{H}_{12}\text{O}_6$       b)  $\text{C}_2\text{H}_4\text{O}_2$       c)  $\text{C}_3\text{H}_6\text{O}_3$       d)  $\text{CH}_2\text{O}$

11. What is the percent by mass of phosphorus in the biological compound, fructose-1,6-diphosphate, which has the molecular formula  $C_6H_{14}O_{12}P_2$ ?
- a) 9.11%                      b) 22.4%                      c) 27.3%                      d) 18.2%
12. What is the empirical formula of a compound that contains 24.5% carbon, 28.6% nitrogen, and 46.9% sodium?
- a)  $Na_2CN$                       b)  $NaCN$                       c)  $Na_2CN_2$                       d)  $Na(CN)_2$
13. The combustion of 3.42 g of a compound is known to contain only nitrogen and hydrogen gave 9.82 g of  $NO_2$  and 3.85 g of water. Determine the empirical formula of this compound.
- a)  $NH_2$                       b)  $N_2H$                       c)  $NH_3$                       d)  $NH_4$
14. What is the molecular formula of a compound whose molar mass is 124 g and whose empirical formula is  $CH_3O$ ?
- a)  $C_2H_6O$                       b)  $C_4H_{10}O_4$                       c)  $C_3H_9O_3$                       d)  $C_4H_{12}O_4$
15. Quinone, which is used in the dye industry and in photography, is an organic compound containing only C, H, and O. What is the empirical formula of the compound if you find that 0.105 g of the compound gives 0.257 g of  $CO_2$  and 0.0350 g of  $H_2O$  when burned completely? Given a molecular weight of approximately 108 g/mol, what is its molecular formula?
- a)  $C_6H_4O_2$                       b)  $C_3H_2O_2$                       c)  $C_6H_5O$                       d)  $C_4H_4O_2$
16. How many moles of  $KBrO_3$  are required to prepare 0.0700 moles of  $Br_2$  according to the reaction:
- $$KBrO_3 + 5KBr + 6HNO_3 \longrightarrow 6KNO_3 + 3Br_2 + 3H_2O$$
- a) 0.210                      b) 0.0732                      c) 0.0704                      d) 0.220                      e) 0.0233
17. Which of the following statements is FALSE for the chemical equation given below in which nitrogen gas reacts with hydrogen gas to form ammonia gas assuming the reaction goes to completion?
- $$N_2 + 3H_2 \longrightarrow 2NH_3$$
- a) The reaction of one mole of  $H_2$  will produce  $2/3$  moles of  $NH_3$ .  
 b) One mole of  $N_2$  will produce two moles of  $NH_3$ .  
 c) One molecule of nitrogen requires three molecules of hydrogen for complete reaction.  
 d) The reaction of 14 g of nitrogen produces 17 g of ammonia.  
 e) The reaction of three moles of hydrogen gas will produce 17 g of ammonia.
18. Calcium carbide,  $CaC_2$ , is an important preliminary chemical for industries producing synthetic fabrics and plastics.  $CaC_2$  may be produced by heating calcium oxide with coke:
- $$CaO + 3C \longrightarrow CaC_2 + CO$$
- What is the amount of  $CaC_2$  which can be produced from the reaction of excess calcium oxide and 10.2 g of carbon? (Assume 100% efficiency of reaction for purposes of this problem.)
- a) 18.1 g                      b) 28.4 g                      c) 20.8 g                      d) 19.8 g                      e) 27.2 g

19. When 12 g of methanol ( $\text{CH}_3\text{OH}$ ) was treated with excess oxidizing agent ( $\text{MnO}_4^-$ ), 14 g of formic acid ( $\text{HCOOH}$ ) was obtained. Using the following chemical equation, calculate the percent yield.



- a) 100%                      b) 92%                      c) 82%                      d) 70%                      e) 55%

20. A commercially valuable paint and adhesive stripper, dimethyl sulfoxide (DMSO),  $(\text{CH}_3)_2\text{SO}$ , can be prepared by the reaction of oxygen with dimethyl sulfide,  $(\text{CH}_3)_2\text{S}$ , using a ratio of one mole oxygen to two moles of the sulfide:



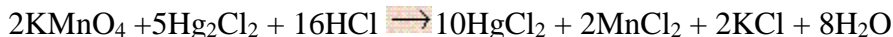
If this process is 83% efficient, how many grams of DMSO could be produced from 65 g of dimethyl sulfide and excess  $\text{O}_2$ ?

- a) 68 g                      b) 75 g                      c) 83 g                      d) 51 g                      e) 47 g

21. The limiting reagent in a chemical reaction is one that:

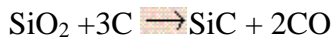
- a) has the largest molar mass (formula weight).                      b) has the smallest molar mass (formula weight).  
c) has the smallest coefficient.                      d) is consumed completely.  
e) is in excess.

22. If 5.0 g of each reactant were used for the following process, the limiting reactant would be:



- a)  $\text{KMnO}_4$                       b)  $\text{HCl}$                       c)  $\text{H}_2\text{O}$                       d)  $\text{Hg}_2\text{Cl}_2$                       e)  $\text{HgCl}_2$

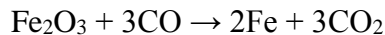
23. Silicon carbide, an abrasive, is made by the reaction of silicon dioxide with graphite.



If 100 g of  $\text{SiO}_2$  and 100 g of C are reacted as far as possible, which one of the following statements will be correct?

- a) 111 g of  $\text{SiO}_2$  will be left over.                      b) 44 g of  $\text{SiO}_2$  will be left over.  
c) 82 g of C will be left over.                      d) 40 g of C will be left over.  
e) Both reactants will be consumed completely, with none of either left over.

24. If 121 g of iron (III) oxide ( $\text{Fe}_2\text{O}_3$ ) react with 584 g of carbon monoxide (CO) in the following reaction, what mass of the excess reagent is left at the end of the reaction?



- a)  $5.20 \times 10^2$  g                      b)  $1.39 \times 10^1$  g                      c)  $3.47 \times 10^2$  g                      d)  $5.41 \times 10^2$  g

25. When 4.0 moles of  $\text{CaCO}_3$  are heated, it decomposes to produce 2.9 moles of  $\text{CaO}$  according to the reaction below. What is the percent yield of  $\text{CaO}$ ?



- a) 29%                      b) 40%                      c) 73%                      d) 1.4%